

CLAIMS

1. A hydrotapping power unit for powering a hydrotapping tool comprising a shaft adapted to advance and retract the tool with respect to a part while the part is contained in a hydroforming die cavity, a first powered device, a lead screw connection operatively connecting said first powered
5 device and said shaft having a thread pitch equal to that of a thread-forming portion of the tool, a second powered device drivingly connected to said shaft and adapted to rotate said shaft in a forward direction and in cooperation with said lead screw connection advance said shaft and thereby the tool to a home position where a piercing end of the tool is located at least
10 substantially flush with the die cavity during hydroforming of the part, said first powered device adapted to cooperate with said lead screw connection to further advance said shaft and thereby force the piercing end of the tool to pierce a hole in the part while hydroforming pressure is maintained in the part and thereafter continue to advance said shaft causing an extruding
15 portion of the tool to enter the hole and inwardly extrude the part about the hole, a third powered device adapted to prevent shock loading on the tool during the piercing operation from reaching said lead screw connection, said second powered device operable to again rotate said shaft in said forward direction and in cooperation with said lead screw connection further advance
20 the tool and thereby form a thread in the hole with the thread-forming portion of the tool, and said second powered device operable to rotate said shaft in a reverse direction and in cooperation with said lead screw connection retract the tool from the threaded hole at the same said feed rate.

2. A hydrotapping power unit as set forth in claim 1 wherein said first and third powered devices are hydraulic cylinders and said second powered device is a hydraulic motor.

3. A hydrotapping power unit as set forth in claim 1 wherein said third powered device includes a thrust bearing and a hydraulically operated piston adapted to engage said thrust bearing with said shaft so as to intercept the shock loading before reaching said lead screw connection.

4. A hydrotapping power unit as set forth in claim 1 wherein said first powered device is a hydraulically operated device comprising a stationary primary cylinder and a primary piston received in said primary cylinder, said third powered device is a hydraulically operated device
5 comprising a secondary cylinder joined to said primary piston and a secondary piston received in said secondary cylinder adapted to operatively engage said shaft so as to intercept the shock loading before reaching said lead screw connection, said second powered device is a hydraulically
operated motor mounted on said primary piston, an anti-rotation device
10 prevents rotation of said primary piston and said secondary cylinder and said motor relative to said primary cylinder, and said lead screw connection connects said shaft to said primary piston and said secondary cylinder.

5. A hydrotapping power unit as set forth in claim 1 wherein said first powered device is adapted to also advance a partial thread/hole-sizing portion of the tool and then a relief portion of the tool into the pierced hole, and said second powered device is adapted to start forward rotation of said
5 shaft while the relief portion of the tool is in the pierced hole.

6. A hydrotapping power unit as set forth in claim 1 wherein said first powered device is a hydraulically operated device comprising a stationary primary cylinder and a primary piston received in said primary cylinder and connected by said lead screw connection to said shaft, said
5 second powered device is a hydraulic motor adapted to move conjointly with

said primary piston, and said third powered device is a hydraulically operated device comprising a secondary cylinder joined to said primary piston and a secondary piston received in said secondary cylinder and a thrust bearing received about said shaft wherein said secondary piston is adapted to engage said thrust bearing with said shaft to thereby intercept the shock loading before reaching said lead screw connection.

7. A hydrotapping power unit as set forth in claim 1 wherein said powered devices and said shaft have a common centerline.

8. A hydrotapping power unit as set forth in claim 1 wherein said powered devices are adapted to be operated at various speeds of operation.

9. A hydrotapping power unit as set forth in claim 4 wherein said primary piston is adapted to act in cooperation with said lead screw connection to hold the tool in said home position during hydroforming of the part.

10. A hydrotapping power unit as set forth in claim 4 wherein said secondary piston is adapted to hold the tool in said home position during hydroforming of the part.

11. A hydrotapping power unit as set forth in claim 4 wherein a coupling device maintains a drive connection between said motor and said shaft throughout linear movement of said shaft with respect to said motor.

12. A hydrotapping power unit as set forth in claim 4 wherein said anti-rotation device comprises at least one pin adapted to prevent relative rotation between said motor and said primary cylinder and thereby prevent rotation of said primary piston and said secondary cylinder while

- 5 permitting conjoint linear movement of said motor and said primary piston and said secondary cylinder.